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GB 2169105 A GB 2053513 A GB 2010957 A
GB 1395749 A EP 0148318 A1 WO 85/01773 A1
DE 3332813 A

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WPI

(54) Window winder

(57) A window winder for use in motor vehicles comprises an electrical drive motor 10 controlled by a microcontroller 9 which monitors rate of change of current supplied to the motor 10 during closure of a window. If the rate of change of current exceeds a predetermined rate, because, for example, the window is obstructed, the microcontroller will reverse and/or stop the motor.

Monitoring during motor startup may be prevented. The microcontroller 9 may also monitor the current supplied to the motor 10 and will reverse and/or stop the motor if the current exceeds a predetermined current value.

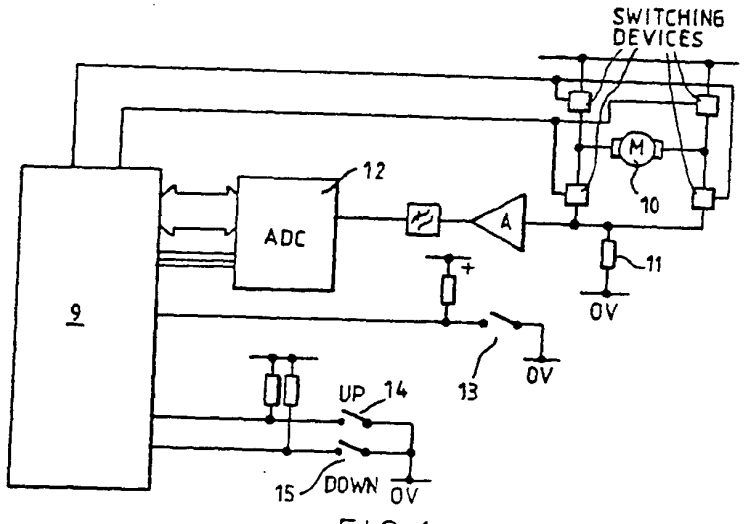

FIG.1

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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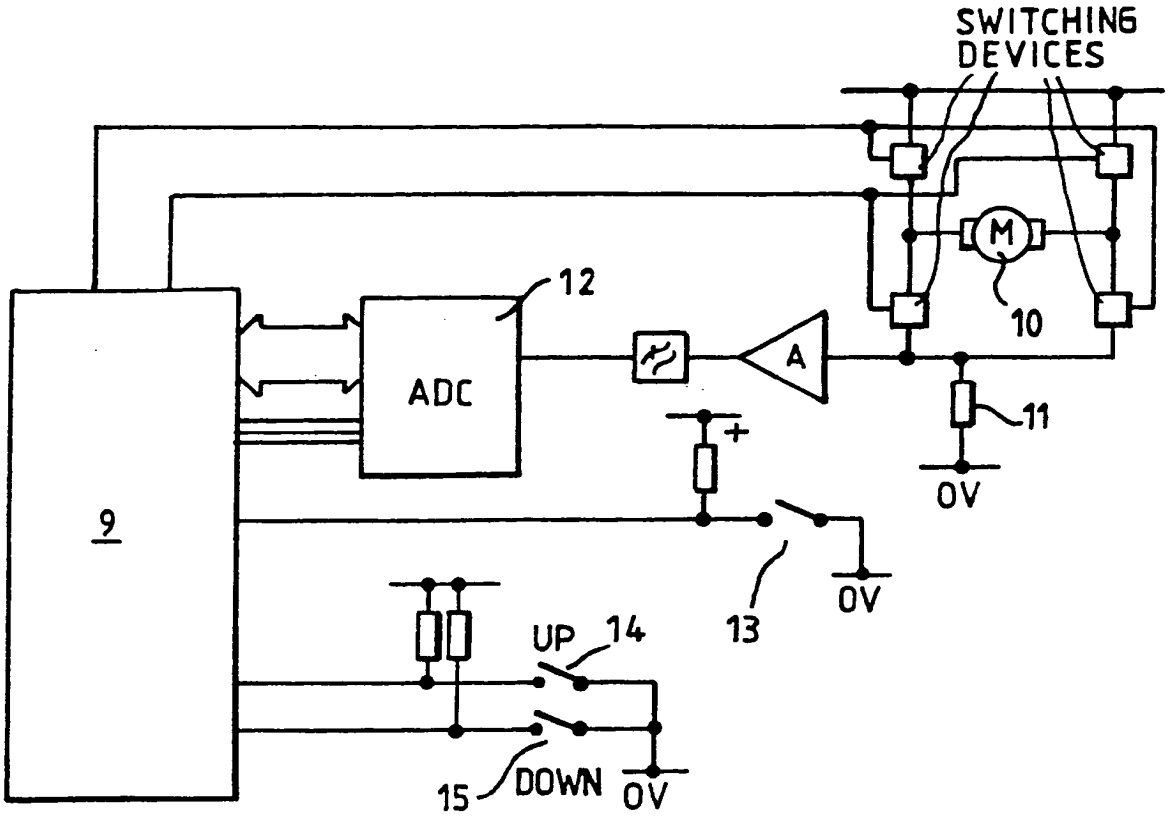
SWITCHING DEVICES
M
10
12
ADC
A
11
+
OV
9
13
OV
UP
14
15
DOWN
OV

FIG.1

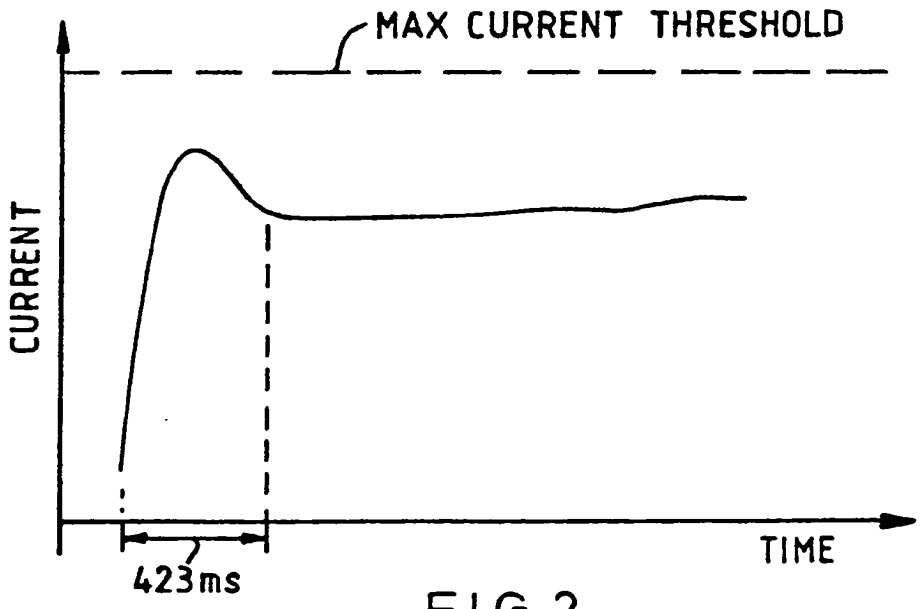
MAX CURRENT THRESHOLD
CURRENT
TIME
423ms

FIG.2

M&C FOLIO: 230P59416 WANGDOC: 0179G

WINDOW WINDER

The invention relates to window winders.

The invention relates more particularly to electrically operated window winder apparatuses for use in motor vehicles. Conveniently, the use of such winders enables windows of a vehicle to be opened and closed by a one touch operation of a button or other electrical switch. However, in such arrangements, it is necessary to prevent the window closing when obstructed, especially if the obstruction could be limb or the head of a person or domestic animal. Such an arrangement for preventing accidents has already been described in UK patent specification 2199963A.

It is an object of the present invention to provide a simpler and/or cheaper arrangement.

According to the invention there is provided a window winder or closure apparatus including an electrical drive motor and a control circuit arranged during closure of the window to monitor continuously the rate of change of current supplied to the motor and to reverse temporarily the direction of and then stop the motor if that rate exceeds a predetermined rate.

The control circuit is preferably inhibited for the first few revolutions of the motor or the first short period of each operation of the motor.

The control circuit may be arranged to reverse temporarily the direction and then stop the motor if the current supplied to the motor at any time exceeds a predetermined current value.

A window winder apparatus according to the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a schematic control circuit for the apparatus; and
Figure 2 is a typical current time graphical representation for the apparatus in use.

Whenever the motor runs, the motor current is determined at fixed intervals from which the rate of change of current is determined. The actual rate is compared with a set or predetermined rate and if the actual rate exceeds the predetermined rate the motor is initiated to reverse its direction briefly and then stop. A set or predetermined current is also provided against which the current is compared and if the predetermined current is exceeded a secondary safety override is provided to stop the motor and normally to reverse its direction briefly

as above. The predetermined current is calculated with respect to the vehicle battery supply voltage which is measured at regular intervals.

Referring to the drawings, a microcontroller 9 which controls a window drive motor 10, is fed with a signal from a sense resistor 11 via an analogue-to-digital converter 12. The signal from the resistor 11 is filtered to remove motor noise and provide higher accuracy for the analogue-to-digital conversion. A limit switch 13 is fitted to the door of the vehicle to provide a window-closed signal. The switch 13 is positioned such that a window is inside the window guard before the switch is initiated and the motor stopped.

If a reading of current amplitude is taken at time t1 and again at time t2 which is a fixed small time interval after t1, the rate of change of current DI/Dt is

$$\frac{di}{dt} = \frac{I(t2)-I(t1)}{t2 - t1}$$

As the time period t1 to t2 is constant Di/dt is proportional to I(t2)-I(t1). Thus the calculation can be used by the system to detect the beginning of a stall condition to initiate an antitrap window back-off. This comprises controlling the motor to reverse its direction

briefly and then stopping the motor. Constant frictional forces or slow changes in frictional force do not affect the performance of the control system even though the average current in the motor may change. However, the current profile or rate of change of current caused by these variations is not significant in use of the apparatus.

The motor is initiated to cause the window to open or close by a one touch operation using an appropriate of switches 14 or 15. The system does not respond to rates of change of current for the first 432 ms and so the control system ignores any high values of rates of change of current caused by surge currents when first starting the motor. In this small time interval the window will in any event have moved an insufficient distance and so not cause any damage to a trapped object or obstruction.

The control system also monitors the actual motor current level at all times (see Figure 2) and causes the motor to reverse briefly and/or to stop if a predetermined set value of this current is exceeded.

The described control circuit may be used with a one touch initiation system and also with switches which selectively provide one touch operation as well as

manually controlled switching. Normally, the described control circuit is arranged to monitor the rate of change of motor current only when the motor is not under manual switching control, but the control system could be arranged to override a manually controlled operation if desired. The predetermined rate of change of current and/or the predetermined maximum current level may be adjustable in a manner to allow the operator to make changes in the values set from time to time to compensate for the operation of the motor varying through environmental changes or normal "wear and tear".

M&C FOLIO: 230P59416 WANGDOC: 0265I

CLAIMS:

1. A window winder or closure apparatus comprising an electrical drive motor and a control circuit arranged to monitor continuously the rate of change of current supplied to the motor during closure of the window and to reverse temporarily the direction of and then stop the motor if that rate exceeds a predetermined rate.

2. A window winder as claimed in claim 1, wherein the control circuit is inhibited for the first few revolutions of the motor.

3. A window winder as claimed in claim 1, wherein the control circuit is inhibited for an initial period of each operation of the motor.

4. A window winder as claimed in claim 1, 2 or 3, wherein the control circuit is arranged to monitor the current supplied to the motor during closure of the window and to reverse temporarily the direction of and then stop the motor if the current supplied to the motor at any time exceeds a predetermined current value.

5. A window winder or closure apparatus substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

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